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EXAMINER

WEBB, GREGORY E

| ART UNIT | PAPER NUMBER |
|----------|--------------|
|----------|--------------|

1751

DATE MAILED: 09/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/635,046

Applicant(s)

SUBAWALLA ET AL.

Examiner

Gregory E. Webb

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 15 August 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-30 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date <u>08.15.2005</u> | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) and the Intellectual Property and High Technology Technical Amendments Act of 2002 do not apply when the reference is a U.S. patent resulting directly or indirectly from an international application filed before November 29, 2000. Therefore, the prior art date of the reference is determined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-12, 14-20, and 22-30 are rejected under 35 U.S.C. 102(e) as being anticipated by Roeder, Jeffrey F. (US20040224865).

Concerning the dense fluid, preferred dense phase fluid and the most preferred dense fluid, Roeder, Jeffrey F. teaches the following:

[0026] Supercritical fluids such as supercritical carbon dioxide (SCCO₂) might at first glance be regarded as attractive reagents for cleaning applications in semiconductor manufacturing, since supercritical fluids have the characteristics of both liquids as well as gases. Like a gas, the supercritical fluid diffuses rapidly, has low viscosity and near-zero surface tension, and penetrates easily into deep trenches and vias. Like a liquid, the supercritical fluid has bulk flow capability as a "wash" medium.

Concerning the claimed acetylenic compound, Roeder, Jeffrey F. teaches the following:

[0049] Surfactants useful in the cleaning compositions of the present invention can be of any suitable type, including anionic, neutral, cationic, and zwitterionic types. Illustrative surfactant species include, without limitation, acetylenic alcohols and diols, and long alkyl chain secondary and tertiary amines. Specific surfactant examples include 3,4-dimethyl-1-hexyn-3-ol and 2,4,7,9-tetramethyl-5-decyn-4,7-diol. Fluorinated surfactants are also advantageously employed surfactant species in various embodiments of the invention.

Concerning the claimed entrainer, Roeder, Jeffrey F. teaches the following:

[0035] The co-solvent species can be a single component co-solvent or a mixture of two or more co-solvent species. Such co-solvent component(s) can be present in the supercritical fluid-based cleaning composition at any suitable concentration, consistent with solubility of the co-solvent

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species in the supercritical fluid.

Concerning the preferred co-solvent, Roeder, Jeffrey F. teaches the following:

4. The cleaning composition of claim 1, wherein said organic co-solvent comprises a solvent selected from the group consisting of: xylene, methanol, ethanol, isopropyl alcohol, N-methylpyrrolidone, N-octylpyrrolidone, N-phenylpyrrolidone, dimethylsulfoxide, sulfolane, catechol, ethyl lactate, acetone, methyl ethyl ketone, butyl carbitol, monoethanolamine, butyrol lactone, diglycol amine, alkyl ammonium fluoride, .gamma.-butyrolactone, butylene carbonate, ethylene carbonate, and propylene carbonate.(see claim 4)

Concerning the preferred chelating agent, Roeder, Jeffrey F. teaches the following:

10. The cleaning composition of claim 9, wherein said acid is selected from the group consisting of: carboxylic acids, perfluorocarboxylic acids, alkyl sulfonic acids, and aryl sulfonic acids.(see claim 10)

Concerning the preferred dense fluids, Roeder, Jeffrey F. teaches the following:

37. The method of claim 36, wherein the supercritical fluid comprises a fluid selected from the group consisting of: carbon dioxide, oxygen, argon, xenon, ammonia, and mixtures thereof.(see claim 37)

Concerning the preferred substrates, Roeder, Jeffrey F. teaches the following:

- [0002] The present invention relates to supercritical fluid-based compositions and methods useful in semiconductor manufacturing for the removal of unwanted material from semiconductor manufacturing equipment

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as well as semiconductor substrates and device structures.

Concerning the preferred pressure range and the preferred temperature range, Roeder, Jeffrey F. teaches the following:

[0073] In one application of such cleaning approach, a tetraethylorthosilicate (TEOS) canister can be cleaned with a supercritical CO.sub.2 composition in a high-pressure chamber. The cleaning pressures for such cleaning can be widely varied, and in specific embodiments can for example be in a range of from 73 to 300 atmospheres, at temperatures in a range of from 32.degree. C. to 80.degree. C. The supercritical CO.sub.2 composition for such application is advantageously formulated with 0.1% to 20% alcohol, such as ethanol or isopropanol. The canister is first soaked with the SCCO2/alcohol composition for 1 to 5 minutes and then flushed with supercritical CO.sub.2 three times, involving exposure to SCCO2 followed by decompression and transition of the CO.sub.2 to a non-supercritical gaseous form. After the decompression, the canister is cleaned and dried and ready for use.

Claims 1-30 are rejected under 35 U.S.C. 102(b) as being anticipated by Bijl, Dirk Johannes (US20010023237).

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Concerning the dense fluid, most preferred dense fluid, preferred pressure range and the preferred temperature range, Bijl, Dirk Johannes teaches the following:

[0025] "Supercritical fluid carbon dioxide" means carbon dioxide which is at or above the critical temperature of 31.degree. C. and the critical pressure of 7.2 Mpa (71 atmospheres) and which cannot be condensed into a liquid phase despite the addition of further pressure. The term "densified carbon dioxide" encompasses both liquid and supercritical fluid carbon dioxide.

Concerning the preferred dense phase fluid, Bijl, Dirk Johannes teaches the following:

[0124] Usually, the method of bleaching comprises loading a variety of soiled articles, preferably clothing, into a vessel (preferably a pressurisable vessel) and contacting the articles with the bleaching composition comprising the inorganic bleaching agent. The bleaching composition minus the carbon dioxide may be contacted with the soiled articles before or together with the carbon dioxide. The carbon dioxide may be introduced into the cleaning vessel as described in U.S. Pat. No. 5,683,473. Preferably, the carbon dioxide is introduced into the cleaning vessel which is then pressurised to a pressure in the range of about 0.1 to about 68.9 MPa and adjusted to a temperature range of from about -78.5.degree. C. up to about 100.degree. C. Although it may not always be desirable, the bleaching method may be carried out in supercritical carbon dioxide where the temperature is between 31.degree. C. and

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100.degree. C., preferably between 31.degree. C. and 60.degree. C. Often it is preferred that the carbon dioxide is in a liquid phase so the temperature is held at -78.5.degree. C. up to about 30.degree. C.

Preferably the pressure range is from 0.5 to 48 MPa, more preferably from 2.1 to 41 MPa. Preferably, the temperature range is from -56.2 to 25.degree. C., more preferably from -25.degree. C. to 20.degree. C. After the bleaching step, the articles may be rinsed by introducing fresh carbon dioxide into the vessel after removing the bleaching composition.

Concerning the claimed acetylenic compound, Bijl, Dirk Johannes teaches the following:

4 TABLE 4

Ingredient Concentration

Carcoat 2 mM

Surfynol 440* 0.05% (w/v)

Water 0.1%

(w/v)

*Surfynol 440 is an ethoxy-modified tertiary

acetylenic glycol surfactant from Air Products.(see table 4)

Concerning the claimed entrainer, Bijl, Dirk Johannes teaches the following:

[0111] Particularly useful surfactants are selected from the group consisting of the classes of ethoxy modified polydimethylsiloxanes (e.g. Silwet.TM. surfactants from Witco), acetylenic glycol surfactants (from Air Products) and ethoxy/propoxy block copolymers (e.g. Pluronic.TM.

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surfactants from BASF) and mixtures thereof (noting that the Pluronic broadly meets the limitation of a glycol).

Concerning the preferred nitrile, Bijl, Dirk Johannes teaches the following:

[0112] The inventive bleach composition also comprises a bleach-compatible solvent. The type of solvent will depend on the exact nature of the bleaching agent. If the bleaching agent is more or less hydrophobic then a hydrophobic fluid may be preferred. Alternatively if the organic substance is more or less hydrophilic, a hydrophilic fluid may be preferred. In many cases it will be preferable, to dissolve or to disperse bleaching agent in an aqueous solvent such as water. Preferred amounts of bleach-compatible solvent should be from 0.0001 to about 10 wt % (weight/weight of the carbon dioxide), more preferably 0.001 to about 5 wt %, even more preferably 0.01 to about 3 wt %, most preferably from about 0.05 to about 0.2 wt %. Preferred solvents include water, ethanol, acetone, hexane, methanol, glycols, acetonitrile, C.sub.1-10 alcohols and C.sub.5-15 hydrocarbons. Especially preferred solvents include water, ethanol and methanol.(par#115)

Concerning the preferred chelating agent, Bijl, Dirk Johannes teaches the following:

[0070] L and L' are each independently a C.sub.1-25 straight chain or branched alkyl or unsubstituted aryl; and Z is a hydrogen, carboxylic acid, hydroxyl, a phosphate, a sulfonyl, a sulfate, an ammonium, a polyalkylene oxide, or a carbohydrate, preferably unsubstituted. G groups

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which are preferred include H.sup.+, Li.sup.+, Na.sup.+, NH.sup.+sub.4,

Cl.sup.-, Br.sup.- and tosylate.(noting that a carboxylic acid functionality in formula II would broadly meet the limitation of a carboxylic acid)

Concerning the preferred dense fluids, Bijl, Dirk Johannes teaches the following:

[0125] It is noted that other densified molecules having supercritical properties may also be employed alone or in mixture. These molecules include methane, ethane, propane, ammonia, butane, n-pentane, n-hexane, cyclohexane, n-heptane, ethylene, propylene, methanol, ethanol, isopropanol, benzene, toluene, p-xylene, sulfur dioxide, chlorotrifluoromethane, xenon trichlorofluoromethane, perfluoropropane, chlorodifluoromethane, sulfur hexafluoride and nitrous oxide.(par#128)

Claims 1-12, 14-20, and 22-30 are rejected under 35 U.S.C. 102(e) as being anticipated by Xu, Chongying (US20050181613).

Concerning the dense fluid and the most preferred dense fluid, Xu, Chongying teaches the following:

112. The method of claim 75, wherein the supercritical fluid comprises at least one supercritical fluid selected from the group consisting of carbon dioxide and argon.

Concerning the preferred dense phase fluid, Xu, Chongying teaches the following:

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[0063] For example, in SCF-based copper (II) precursor compositions, isopropyl alcohol may be added in a concentration of from about 0.1% to about 99.9% by weight, based on the weight of the SCF component(s). The use of IPA as an enhancing agent is highly advantageous when the SCF component is carbon dioxide, since isopropyl alcohol may increase copper precursor solubility in the supercritical carbon dioxide, while simultaneously functioning as a reducing agent to reduce Cu (II) to Cu (0). The isopropyl alcohol may be oxidized to acetone during the deposition process, and is readily recovered from the SCF effluent discharged from the deposition chamber, for recovery and reuse thereof, or alternatively for other disposition.

Concerning the claimed acetylenic compound and the preferred chelating agent, Xu, Chongying teaches the following:

103. The method of claim 102, wherein said at least one surfactant comprises a surfactant selected from the group consisting of acetylenic alcohols, acetylenic diols, long alkyl chain secondary and tertiary amines, and fluorinated derivatives of the foregoing.

Concerning the claimed entrainer, Xu, Chongying teaches the following:

104. The method of claim 103, wherein said at least one surfactant comprises a surfactant selected from the group consisting of:
3,4-dimethyl-1-hexyn-3-ol; 2,4,7,9-tetramethyl-5-decyn-4,7-diol; and
fluorinated surfactants.

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Concerning the preferred co-solvent, Xu, Chongying teaches the following:

79. The method of claim 79, wherein said co-solvent comprises a solvent selected from the group consisting of: methanol, ethanol, isopropyl alcohol, N-methylpyrrolidone, N-octylpyrrolidone, N-phenylpyrrolidone, dimethylsulfoxide, sulfolane, catechol, ethyl lactate, acetone, butyl carbitol, monoethanolamine, butyrol lactone, diglycol amine, .gamma.-butyrolactone, butylene carbonate, ethylene carbonate, and propylene carbonate.

Concerning the preferred dense fluids, Xu, Chongying teaches the following:

[0023] Examples of SCF species useful in the broad practice of the invention include, but are not limited to, carbon dioxide, oxygen, argon, krypton, xenon, ammonia, methane, methanol, dimethyl ketone, hydrogen, forming gas, and sulfur hexafluoride.

Claims 1-30 are rejected under 35 U.S.C. 102(e) as being anticipated by McDermott, Wayne Thomas (US20040055621).

Concerning the dense fluid and the most preferred dense fluid, McDermott, Wayne Thomas teaches the following:

[0117] Since the internal volume of the vessel and the mass of carbon dioxide in the vessel remain essentially unchanged during the heating

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step, the average density of the captured carbon dioxide will remain essentially unchanged at 29.2 lb/ft.³ regardless of the temperature and pressure. In this example, heating the selected initial charge of carbon dioxide isochorically (at constant volume) at a fixed density of 29.2 lb/ft.³ will pass through the critical point at the critical temperature of 87.9.degree. F. and the critical pressure of 1,071 psia. Additional heating will form a supercritical fluid at the desired temperature and pressure having a fixed density of 29.2 lb/ft.³. Using a smaller initial quantity of liquid carbon dioxide in the vessel will result in a lower density supercritical fluid; conversely, using a greater initial quantity of liquid carbon dioxide in the vessel will result in a higher density supercritical fluid. Heating a higher density supercritical fluid to a given temperature will generate a higher pressure than heating a lower density supercritical fluid to the same temperature.

Concerning the claimed acetylenic compound, claimed entrainer, preferred co-solvent, preferred nitrile and the preferred chelating agent, McDermott, Wayne Thomas teaches the following:

[0140] The exemplary process described above with reference to FIG. 3 may utilize one or more entrainers mixed with a dense fluid to provide a dense film stripping or cleaning fluid containing 0.1 to 20 wt % entrainer. An entrainer is defined as a processing agent that enhances the cleaning ability of the dense fluid to remove contaminants from a

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contaminated article. Entrainers generally may include solvents, surfactants, chelators and chemical modifiers. Some examples of representative entrainers include acetylenic alcohols and diols, organosilicones, ethyl acetate, ethyl lactate, propyl acetate, butyl acetate, diethyl ether, dipropyl ether, methanol, ethanol, isopropanol, acetonitrile, propionitrile, benzonitrile, ethylene cyanohydrin, ethylene glycol, propylene glycol, ethylene glycol monoacetate, propylene glycol monoacetate, acetone, butanone, acetophenone, trifluoroacetophenone, triethyl amine, tripropyl amine, tributyl amine, 2,4, dimethyl pyridine, dimethylethanolamine, diethylethanolamine, diethylmethanolamine, dimethylmethanolamine, dimethylformamide, dimethylacetamide, ethylene carbonate, propylene carbonate, acetic acid, lactic acid, butane-diol, propane-diol, n-hexane, n-butane, hydrogen peroxide, t-butyl hydroperoxide, and chelating agents such as ethylenediaminetetraacetic acid (EDTA), catechol, choline, beta-diketone and beta-ketoimine ligands, trifluoroacetic anhydride (TFM), halogenated carboxylic acids, halogenated glycols, and halogenated alkanes.

Concerning the preferred dense fluids, McDermott, Wayne Thomas teaches the following:

4. The method of claim 1 wherein the dense fluid comprises one or more components selected from the group consisting of carbon dioxide, nitrogen, methane, oxygen, ozone, argon, hydrogen, helium, ammonia, nitrous oxide, hydrogen fluoride, hydrogen chloride, sulfur trioxide,

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sulfur hexafluoride, nitrogen trifluoride, monofluoromethane, difluoromethane, trifluoromethane, trifluoroethane, tetrafluoroethane, pentafluoroethane, perfluoropropane, pentafluoropropane, hexafluoroethane, hexafluoropropylene, hexafluorobutadiene, and octafluorocyclobutane and tetrafluorochloroethane.(see claim 4)

Concerning the preferred substrates, McDermott, Wayne Thomas teaches the following:

[0128] A wide variety of contamination-sensitive articles may be encountered in the fabrication of microelectronic devices, and these micro-electromechanical devices can be cleaned or processed using the present invention. Such articles may include, for example, silicon or gallium arsenide wafers, reticles, photomasks, flat panel displays, internal surfaces of processing chambers, printed circuit boards, surface mounted assemblies, electronic assemblies, sensitive wafer processing system components, electro-optical, laser and spacecraft hardware, surface micro-machined systems, and other related articles subject to contamination during fabrication. Typical contaminants that can be removed from these articles in a cleaning process may include, for example, low and high molecular weight organic contaminants such as exposed photoresist material, photoresist residue, UV- or X-ray-hardened photoresist, C-F-containing polymers and other organic and inorganic etch residues, ionic and non-ionic inorganic metal-containing compounds, moisture, and insoluble materials including post-planarization particles.

Concerning the preferred pressure range, McDermott, Wayne Thomas teaches the following:

[0096] A single-component supercritical fluid is defined as a fluid above its critical temperature and pressure. A related single-component fluid having similar properties to a supercritical fluid is a single-phase fluid which exists at a temperature below its critical temperature and a pressure above its liquid saturation pressure. In the present disclosure, the term "dense fluid" as applied to a single-component fluid is defined to include both a supercritical fluid and a single-phase fluid which exists at a temperature below its critical temperature and a pressure above its saturation pressure. A single-component dense fluid also can be defined as a single-phase fluid at a pressure above its critical pressure or a pressure above its liquid saturation pressure. The term "component" as used herein means an element (for example, hydrogen, helium, oxygen, nitrogen) or a compound (for example, carbon dioxide, methane, nitrous oxide, sulfur hexafluoride).

Concerning the preferred temperature range, McDermott, Wayne Thomas teaches the following:

[0023] The dense fluid may be generated in (b2) at a reduced temperature in the pressurization vessel below about 1.8, wherein the reduced temperature is defined as the average absolute temperature of the dense fluid in the pressurization vessel after heating divided by the absolute critical temperature of the fluid. The contacting of the article with the dense processing fluid in the processing chamber in (d) may be effected

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at a reduced temperature in the processing chamber between about 0.8 and about 1.8, wherein the reduced temperature is defined as the average absolute temperature of the dense processing fluid in the processing chamber during (d) divided by the absolute critical temperature of the dense processing fluid.

Claims 1-12, 14-20, and 22-30 are rejected under 35 U.S.C. 102(e) as being anticipated by McDermott, Wayne Thomas (US20040055624).

Concerning the dense fluid, McDermott, Wayne Thomas teaches the following:

[0067] Supercritical fluids are ideal for these applications because these fluids characteristically have high solvent power, low viscosity, high diffusivity, and negligible surface tension relative to the articles being processed. As pointed out above, the supercritical fluids used in microelectronic processing must have extremely high purity, much higher than that of supercritical fluids used in other applications. The generation of extremely high purity supercritical fluids for these applications must be done with great care, preferably using the methods described herein.

Concerning the preferred dense phase fluid and the most preferred dense fluid, McDermott, Wayne Thomas teaches the following:

[0081] In this illustration, valve 319 is open while valves 321, 323, and

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333 are closed. Valve 335 or 337 may be open to supply supercritical carbon dioxide to manifold 331 from pressurization vessel 305 or 309, which previously may have been charged with carbon dioxide and pressurized as described below. Liquid carbon dioxide from supply vessel 301 flows downward into pressurization vessel 303 via manifold 311, valve 319, and line 313. As the liquid carbon dioxide enters pressurization vessel 303, which was warmed in a previous cycle, initial liquid flashing will occur. Warm flash vapor returns upward into the carbon dioxide supply vessel 301 via line 313 and manifold 311 as liquid flows downward into pressurization vessel 303. The warm flash vapor flows back into carbon dioxide supply vessel 301 and increases the pressure therein. Excess vapor flows from supply vessel 301 via line 339 to carbon dioxide liquefier 341, wherein the vapor is cooled and condensed to flow downward via line 339 back to supply vessel 301.

Concerning the claimed acetylenic compound, preferred co-solvent and the preferred chelating agent, McDermott, Wayne Thomas teaches the following:

[0024] The one or more processing agents may be selected from the group consisting of acetylenic alcohols, acetylenic diols, non-ionic alkoxylated acetylenic diol surfactants, non-ionic self-emulsifiable acetylenic diol surfactants, siloxane polymers, silicone-based surfactants, tertiary alkyl amines, quaternary alkyl amines, tertiary di-amines, quaternary di-amines, amides, dimethyl formamide, dimethyl

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acetamide, alkyl alkanolamines, dimethanolethylamine, beta-diketone ligands, beta-ketoimine ligands, trifluoroacetic anhydride, halogenated carboxylic acids, halogenated glycols, halogenated alkanes, and halogenated ketones.(par#58)

Concerning the claimed entrainer, McDermott, Wayne Thomas teaches the following:

[0102] The exemplary process described above with reference to FIG. 3 utilizes an entrainer mixed with a dense fluid to provide a dense film stripping or cleaning fluid containing 0.5 to 20 wt % entrainer. An entrainer is defined as a processing agent which enhances the cleaning ability of the dense fluid to remove contaminants from a contaminated article. Entrainers generally may include solvents, surfactants, chelators and chemical modifiers. Some examples of representative entrainers are acetylenic alcohols, acetylenic diols (non-ionic alkoxylated and/or self-emulsifiable acetylenic diol surfactants), siloxane polymers (silicone-based surfactants and defoamers), alcohols, tertiary and quaternary alkyl amines and di-amines, amides (including aprotic solvents such as dimethyl formamide and dimethyl acetamide), alkyl alkanolamines (such as dimethanolethylamine), and chelating agents such as beta-diketone and beta-ketoimine ligands, trifluoroacetic anhydride (TFAA) and/or halogenated carboxylic acids, glycols, alkanes, and ketones.

Concerning the preferred dense fluids, McDermott, Wayne Thomas teaches the following:

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[0015] The dense fluid may comprise one or more components selected from the group consisting of carbon dioxide, nitrogen, methane, oxygen, ozone, argon, hydrogen, helium, ammonia, nitrous oxide, hydrocarbons having 2 to 6 carbon atoms, hydrogen fluoride, hydrogen chloride, sulfur trioxide, fluoroform, sulfur hexafluoride, nitrogen trifluoride, monofluoromethane, difluoromethane, trifluoromethane, trifluoroethane, tetrafluoroethane, pentafluoroethane, perfluoropropane, pentafluoropropane, hexafluoroethane, and tetrafluorochloroethane.

Concerning the preferred substrates, McDermott, Wayne Thomas teaches the following:

[0104] The term "processing" as used herein means contacting an article with a dense processing fluid to effect physical and/or chemical changes to the article. The term "article" as used herein means any article of manufacture which can be contacted with a dense processing fluid.

Representative articles may include, for example, silicon or gallium arsenide wafers, reticles, photomasks, flat panel displays, internal surfaces of processing chambers, printed circuit boards, surface mounted assemblies, electronic assemblies, sensitive wafer processing system components, electro-optical, laser and spacecraft hardware, surface micro-machined systems, and other related articles subject to contamination during fabrication.

Concerning the preferred pressure range, McDermott, Wayne Thomas teaches the following:

[0068] A single-component supercritical fluid is defined as a fluid above

its critical temperature and pressure. A related single-component fluid having similar properties to a supercritical fluid is a single-phase fluid which exists at a temperature below its critical temperature and a pressure above its liquid saturation pressure. In the present disclosure, the term "dense fluid" as applied to a single-component fluid is defined to include both a supercritical fluid and a single-phase fluid which exists at a temperature below its critical temperature and a pressure above its saturation pressure. A dense fluid which is a single-component fluid also can be defined as a single-phase fluid at a pressure above its critical pressure or a pressure above its liquid saturation pressure. The term "component" as used herein means an element (for example, hydrogen, helium, oxygen, nitrogen) or a compound (for example, carbon dioxide, methane, nitrous oxide, sulfur hexafluoride).

Concerning the preferred temperature range, McDermott, Wayne Thomas teaches the following:

[0091] Sealed process tool 362 is pressurized with the dense cleaning fluid to a typical supercritical pressure of 1,100 to 10,000 psia and a supercritical temperature of up to 500.degree. F. The temperature in process tool 362 is controlled by means of temperature control system 367. Typically, the contacting of articles 363 with the dense cleaning fluid in process tool 362 may be effected at a reduced temperature above 1.0 and below about 1.2, wherein the reduced temperature is defined as the average absolute temperature of the fluid in the cleaning chamber

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divided by the absolute critical temperature of the fluid.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gregory E. Webb whose telephone number is 571-272-1325. The examiner can normally be reached on 9:00-17:30 (m-f).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Yogendra Gupta can be reached on 571-272-1316. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Gregory E. Webb
Primary Examiner
Art Unit 1751

gew